

**ATTACHMENT 4:  
INDOOR DUST SAMPLING PROTOCOLS**

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# INDOOR DUST SAMPLING PROTOCOLS

## 1. OVERVIEW

This document provides protocols for the collection of surface dust and air samples for subsequent analysis for the presence of contaminants of potential concern (COPCs), and the identification of sources within the sampled spaces that may contribute to the observed results. Protocols will be provided for sampling of 1) residential and non-residential units, 2) central heating, ventilation, and air conditioning (HVAC) units, 3) common areas, 4) identification of indoor lead sources, and 5) identification of indoor asbestos and MMVF sources. Within residential and non-residential units in buildings, dust will be collected from three areas; 1) “accessible”, 2) “infrequently accessed”, and 3) “inaccessible” areas

“Accessible” areas are defined as areas in which exposures readily occur including “soft” surfaces such as rugs and upholstered furniture, and “hard” surfaces such as walls, and table tops.

“Infrequently accessed” areas are defined as areas in which dust may accumulate but which cause exposure infrequently such as on top of bookshelves, on top of refrigerators, chests of drawers or other tall objects.

“Inaccessible” areas are defined as areas in which dust may accumulate but which cause exposure rarely such as behind large infrequently moved objects.

“Common” areas are defined as areas not under the control of any one tenant. i.e., lobbies, corridors, stairways, elevators, washrooms in lobby, laundry or recreational rooms, mechanical rooms, etc.

Within HVACs, dust will be collected at air inlets, within mixing plenums, in outlets to sampled units, and from the HVAC filters. The protocol outlined in this document provides instructions for the identification of areas within a building to sample, and then locations within units and HVACs to obtain the samples. Two methods will be used to obtain dust samples for interior building surfaces and are outlined herein: i) a wipe sampling method; and ii) vacuum sampling methods including microvac and HEPA sampling methods. Air samples will also be collected in the accessible portions of residential units and common areas.

## 2. STRATEGY FOR SAMPLING UNITS

### 2.1. Selecting Units

A sampling unit is defined as a reasonably small, confined and well defined area that will vary from building to building and within buildings. The procedure for selecting units follows these steps:

- i. Determine Eligibility as detailed in the Sampling Plan

Testing and cleanup work, as necessary, will be offered in the area below Canal Street and west of Allen-Pike Street. There will be a period of 2 months during which residents and building owners in this area may make requests to participate in this program. Employees and employers will not be eligible for this program.

Individual Residents: Individuals who own or rent their apartment who are concerned that dust from the collapse of the WTC may still be present in their residence may request assistance from EPA.

Buildings: Owners, boards of cooperatives or condominiums and managers of residential or commercial buildings can request to have their building's common areas and HVAC system evaluated and cleaned, as necessary. After receiving the request, and upon signature of appropriate access agreements, common areas and HVAC systems and/or other areas to which building management can provide access will be sampled as described below.

Employees and Employers: The Occupational Safety and Health Act of 1970 gives employees the right to file complaints about workplace safety and health hazards. If employees or their representatives believe that their working conditions are unsafe or unhealthful as a result of contamination by WTC dust they may follow the procedures outlined at <http://www.osha.gov/as/opa/worker/complain.html> to file a complaint. Alternatively, employees, authorized representatives of employees, or employers can request an evaluation by the National Institute of Occupational Safety and Health of possible health hazards associated with a job or workplace. The procedure to be followed is outlined at <http://www.cdc.gov/niosh/hhe/Request.html>.

EPA will implement this effort utilizing the \$7 million in FEMA funding that has been earmarked for this program. In order to ensure that these funds are expended in a manner that will maximize the reduction in potential exposure to remaining dust: EPA will not retest spaces it tested and cleared under the indoor dust cleanup program offered in 2002-2003, EPA will not test spaces that were not cleaned after the collapse of the WTC, are currently uninhabited, and slated for demolition, and EPA will not test in buildings constructed or reconstructed after May 2002 (when the cleanup effort at the WTC site was completed). Requests within the area of confirmed contamination and in closest proximity to the WTC will be given priority for testing.

- ii. Obtain signed access agreements (agreement forms to be provided by EPA)
- iii. Identify and characterize the building and units eligible using EPA provided checklists or survey guidance (for lead and asbestos) for buildings, units and HVAC systems.

Characterizations will include:

### **Descriptive information**

Owner or other responsible individual or party for the building and units;  
Number and location of floors sampled per bldg  
Number of rooms sampled per floor  
Square footage of floors and of space sampled per floor  
Location and orientation (directly facing or the side most directly facing, facing an area perpendicular, facing in the direction opposite) to WTC of space sampled  
Cleaning and renovation history since WTC collapse  
Type, number, age of windows in spaces sampled  
Number of window or wall HVAC units  
Cleaning and replacement history of window or wall HVAC units since WTC collapse  
Visible WTC dust reported present in unit  
Reported cleaning frequency and date of last cleaning prior to sampling  
Carpet present  
Carpet cleaned or replaced since WTC collapse

### **Attribution Information**

Location and amount of friable asbestos material present in sampled space  
Location and area of MMVF present, i.e ceiling tiles, pipe insulation, spray on fireproofing  
Location and amount of chalking/peeling paint present  
(Note: detailed procedures for investigating the above three items are described later in this document.)  
Current use of space  
Significant particulate or combustion sources with sampling area, e.g. fireplace, stove, occupant who smokes  
Significant particulate or combustion sources within or adjacent to the building, e.g. above fast food restaurant, adjacent to emergency diesel generator exhaust

### **Central HVAC Design Information**

Location of air inlets  
Location of filters or other air cleaning devices in system  
Number and Location of HVAC return ducts in sampled space  
Central HVAC cleaning and replacement history since WTC collapse  
Whether or not the unit is served by an HVAC

The intent behind this procedure is to ensure that only eligible buildings or units are sampled; that sufficient information is gathered to characterize the buildings or units sampled and to determine whether sources of COPC exist within or adjacent to the areas sampled.

## **2.2. Selecting Locations within Units to Sample**

Sampling teams will enter sampling units with the intent of collecting individual microvac and wipe samples from no less than 6 and no more than 20 sample locations, for “accessible” and “infrequently accessed” COPC analysis; scaled to floor area as follows: <1000sf = 3 samples, >1000 and <5000sf = 5 samples, >5000sf = 7 samples, >10000sf = 10 samples (for each type of location).

Target areas for “accessible” hard and soft surface sampling in residential units include, if present and in priority order:

- i) area or wall-to-wall carpeting. Carpet locations include, in an order of most to least preferred location (on the basis of exposure considerations): 1) in the main entrance used for access and egress from the building; 2) carpet in the secondary, less heavily used entrance to the house; 3) carpet in the center of the most frequently used play area for children under the age of six; and 4) carpet in an acknowledged or evident route of high traffic flow (i.e., stairs, hallway, etc.);
- ii) the kitchen tiled floor, hardwood floors, or hard floors of other surfaces types (laminated, e.g.);
- iii) draperies/curtains in the living room, which is the primary location if draperies/curtains are to be sampled, and then draperies/curtains in other rooms of the unit;
- iv) the wall at hand level for a resident child, or adult where no children occupy the unit;
- v) the wall adjacent to the head of the bed in a child’s bedroom, or in the adult bedroom where no children occupy the unit;
- vi) kitchen counter tops;
- vii) table tops for tables located in the dining room, living room, family room, or bedroom, and the top of bureaus in bedrooms;
- viii) upholstered furniture.
- ix) window sills

Target areas for accessible hard and soft surface sampling in non-residential units include, if present:

- i) area or wall-to-wall carpeting, and draperies/curtains;
- ii) tiled, hardwood, or other hard-surfaced floors;

- iii) desk or table tops;
- iv) the wall in the most actively used location in the unit;
- v) upholstered furniture;
- vi) window sills

Target areas for infrequently accessed hard and soft surfaces in residential units include, if present:

- i) the trough of a window;
- ii) the top of vent ducts, or hot water pipes;
- iii) on top of large appliances such as refrigerators, or upright freezers;
- iv) on top, beneath , or behind large objects of furniture such as bookcases, tall chests or beds canopies;

Target areas for infrequently accessed hard and soft surfaces in non-residential units include, if present:

- i) the trough of a window;
- ii) the top of vent ducts, or hot water pipes;
- iii) on top, beneath or behind large objects such as built in file cabinets or bookcases;

The following samples will be collected at each of the above sample locations: 1 microvac, 1 PAH wipe, 1 Metal Wipe, plus 1 air sample at locations proximate to the accessible area samples microvac-wipe samples.

Sampling teams will enter sampling units with the intent of collecting a single composite sample from no less than 3 and no more than 10 sample locations, for “inaccessible” COPC and WTC signature analysis; scaled to floor area as follows: <1000sf = 3 locations, >1000 and <5000sf =5 locations, >5000sf =7 locations, >10000sf = 10 locations.

Target areas for inaccessible hard and soft surfaces in residential units include, if present:

- i) beneath or behind infrequently moved heavy appliances such as chest freezers, dishwashers, or stoves;

- ii) in corners of closets or similar small areas not frequently accessed or cleaned;
- iii) above suspended ceilings.

Target areas for inaccessible hard and soft surfaces in non-residential units include, if present:

- i) behind or underneath infrequently moved heavy equipment such as copying machines;
- ii) in corners of closets or similar small areas not frequently accessed or cleaned;
- iii) above suspended ceilings.

A single composite sample from all of the above sample locations will be collected by HEPA for each unit.

Sampling teams will enter into the unit and, at that time, lay out a sampling plan for the unit. They will have in their possession sampling equipment including equipment for air, wipe sampling, and microvac and HEPA vacuuming. The air sampling equipment is to be used to determine the concentration of asbestos and MMVF fibers in air. The wipe and microvac sampling equipment are specifically for the collection of COPC samples, while the HEPA vacuum is only for the collection of bulk dust for the measurement of COPC. Procedures for sampling a chosen location with this equipment are provided below. The building checklist will be completed prior to entry into the unit and provided to the project manager. The unit checklist will be completed before leaving the sampling area and provided to the project manager.

#### **“Accessible” and “Infrequently Accessed” Sampling**

The candidate sample locations and number of samples to be collected are described above. The square footage of the unit is to be measured and the number of sampling locations calculated. Sampling locations are always to be selected in the order presented in the lists above starting at the top and working down. For example in a residential unit of under 1000 square ft, locations i, ii, and iii would always be sampled if they existed. In a unit of over 10,000 square feet, all 9 locations would be selected (if present) and then a 10<sup>th</sup> sample would be collected from the first item on the list (the carpets). The same process will be followed whenever the number of sample locations required exceeds the number of types of locations available. Whenever the number of locations required exceeds the number of types of locations required the selection process will start over again from the top of the list until enough samples have been taken.

There should be equal numbers of metal, PAH and microvac samples collected in the unit. Where possible, air samples will be collected at locations proximate to the accessible metal, PAH and microvac samples. The general strategy for sampling is to emphasize locations where exposure occurs - accessible areas in the locations of most use within the unit; and locations infrequently accessed areas that may serve as a reservoir for recontamination of accessible areas. The strategy for selecting locations for wipe/microvac sampling should consider:

i) good spatial coverage of the entire unit - samples should be distributed throughout and not focus on a limited area of the unit; this is why the entire list should be cycled through

ii) both hard and soft surfaces should be sampled, with roughly an equal number of samples in both types of locations. In the instance where soft surfaces are not present or almost not present, such as a location with all hardwood floors and no upholstered furniture, it may be appropriate to forego soft surfaces.

iii) a PAH and metal wipe as well as a microvac should be sought for each type of location chosen. Where possible all three samples should be adjacent and the air sample collected proximate to them in the accessible areas.

#### **“Inaccessible” area sampling**

A minimum of 3 sample locations will be sampled with the HEPA vacuum for COPC. The number of locations to be sampled required will increase with the square footage of the unit. The process of cycling through the list of possible locations from top to bottom until sufficient samples are collected will be followed. However, there is more emphasis in HEPA sample location on identifying areas that are more likely to contain WTC dust as compared to recently deposited dust. This argues for an emphasis on areas of less contact and exposure, such as infrequently cleaned and inaccessible areas. The strategy for selecting locations for inaccessible area dust collection should consider:

i) locations with enough accumulation of dust such that a sample of sufficient volume can be taken;

ii) locations that may be near an HVAC and hence potentially impacted by contaminants circulating through that system;

iii) locations that, while infrequently cleaned, are at least cleaned on some infrequent basis such that some dust in the area would become resuspended and would serve as an exposure matrix (closets);

iv) depending on the circumstances within the unit, it may be even preferable to forego an infrequently cleaned inaccessible location and instead choose a location that may very rarely if ever cleaned. The rationale for such a selection would be that WTC dust with the pertinent signature may not have been removed from such locations. An example from such a location is under a large copier;

v) soft surfaces are more likely to retain any contamination and a preference should be given to sampling them.

### **2.3. Selecting Locations Within HVACs to Sample**



In order to characterize central HVAC units in volunteered buildings which have full or partial central HVAC units ("full" defined as units serving both common areas and individual apartments, offices, etc; while "partial" is defined as units serving only common areas while apartments or offices have individual units), an evaluation and HEPA and bulk sampling will occur as described in the HVAC sampling and evaluation protocol. The following principles will apply to this sampling.

- i) one composite sample of the outdoor air inlets to HVAC. Inlets that are facing Ground Zero are preferred. Samples will not be taken in an outdoor air inlet where an extraordinary effort is required, such as when the air inlet is located in a location that would require scaffolding or hoists for access;
- ii) one sample per floor of ducting, air mixing plenums or other spaces serving sampled floors. The locations should be accessible and should be in central locations between sampled outlets. If possible, samplers should seek out locations near outlets that are also near bends and turns within the plenum. These locations should be sought because it is possible that dust accumulates in the bends, and these localized repositories could contain WTC dust;
- iii) one sample per floor of all HVAC outlets discharging to locations where wipe, microvac, and air samples (for measurement of COPCs) samples are taken within common areas;
- iv) one composite sample from HVAC filters will be collected. Since filters are changed periodically, it is not expected that the filter will reflect air circulation shortly after September 11, 2001. However, filters might be informative with regard to the potential for ongoing recontamination by dust containing WTC contaminants.

#### **2.4. Selecting Locations in Common Areas for Sampling**

In order to characterize common areas wipe, microvac and ambient air samples will be collected. The following principles will apply to this sampling. Sampling teams will sample the following locations on every floor of buildings volunteered for evaluation. As with unit sampling if more samples are required than there are types of target areas the target area list should be cycled thru from top to bottom until the required number of samples are collected. An effort should be made to collect successive sets of samples at increasing distances from the entrance for access and egress from the building. Thus if the area is large enough to require 5 samples the first 3 would be collected at the floor, wall and ceiling of the entrance to the space. The second set would be collected approximately half way into the space and would be floor and wall samples.

##### **Accessible Area Sampling**

Target areas include: 1) the floor or carpet at entrance used for access and egress from the building, 2 a wall at same location, and 3 the ceiling at same location . One microvac, one PAH wipe, and one metal wipe will be collected at each of these three locations

#### **Inaccessible Area Sampling**

1 sample each behind, below or above 2 or more infrequently moved objects in common areas, mechanical rooms, utility rooms, basements; 2) sample above top door jamb ledge; 3) sample elevator tops

#### **Air Sampling**

Residential building interior common areas also are part of this effort. Common spaces will be sampled without the use of forced air devices (fans, leaf blowers etc). For small spaces, less than 160 square feet, 3 samples will be collected. For large spaces greater than 160 square feet and less than 25,000 square feet 5 samples will be collected. For spaces greater than 25,000 square feet, 1 sample will be collected for each 5,000 square feet. The air samples within a contiguous common area will be collected simultaneously. Sampling equipment shall be placed away from obstructions. Sample equipment shall be placed within 10 feet of HVAC outlets if extant. The procedures used to locate the common space air samplers are also described in Attachment 4 d..

### **3. PROCEDURES FOR SAMPLING**

#### **3.1. Wipe Sampling**

The following equipment is required for surface wipe sampling: 1) painters' tape (used for holding down sampling templates and marking sample locations), 2) glass sample jars, 3) sample labels, 4) sampling template (reusable plastic templates both in square and "L" shapes), 5) measuring tape, 6) moist wipes (wet ones disposable individually packaged wet wipes), 7) field notebook, 8) indelible ink marker, 9) ink pens, 10) refuse bags, and 11) disposable powderless, vinyl gloves

The following steps are required for template assisted wipe sampling for hard surfaces:

- i) pull on a pair of clean, disposable powderless vinyl gloves;
- ii) carefully place an appropriately sized clean template (4 inch sq for lead, 4-12 inch sq for PAH – the precise size of template will be determined after detection limits for PAH are established) on the surface in a manner that minimizes disruption of settled dust. Tape the outer edge of the template to the surface using painters' masking tape to prevent it from moving during sample collection;
- iii) discard gloves used to mark the area in a refuse bag and pull on a new pair of clean, powderless, plastic gloves;

iv) remove appropriate wipe (for lead as specified by HUD, for PAH as determined in consultation with analytical lab) from its packaging, keeping it out of contact with surrounding surfaces;

v) first wiping, side-to-side: Hold one edge of the wipe between the thumb and forefinger, draping the wipe over the fingers of a gloved hand. Hold fingers together, hand flat, and wipe the selected surface area, starting at either corner furthest away from the operator, if a horizontal surface is being sampled, or either upper corner, if a vertical surface is being sampled, using a slow side to side sweeping motion. During wiping, apply pressure to the fingertips. At the end of the first pass from one side to the other, turn the leading edge of the wipe (the portion of the wipe touching the surface) 180 degrees, pulling the wipe path slightly down or closer to the operator make a second side-to-side pass in the reverse direction, slightly overlapping the first pass. Continue to cover the sampling area within the template, using the slightly overlapping side-to-side passes with the 180 degree turns at each edge until the close/bottom corner of the template is reached. Carefully lift the leading dust line into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half with the sample side folded inside the fold;

vi) second wiping, top-to-bottom: using a clean side of the wipe, perform a second wiping over the sampling area within the template starting from a far/top corner in the same manner used for the first wiping, except use a top-to-bottom sweeping of the surface. When the close/bottom corner of the template is reached, carefully lift the leading dust line into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half (again) with the sample from this second wiping folded inside the fold;

viii) third wiping, clean corners: using a clean side of the wipe, perform a third wiping around the perimeter of the sampling area within the template to pick up any dust remaining in the corners. Start from one edge of the template and use the same wiping technique as described above. When the perimeter has been wiped and the starting location reached, carefully lift the leading dust line into the wipe. Fold the wipe in half one more time with the sample from this third wiping folded inside the fold;

ix) insert the folded wipe into a sample jar. Label the jar with a DCS sample label detailing sample location and property sampled;

x) make a sketch of the sample location in a field notebook and record an accurate measure of the inner dimensions to the nearest one millimeter of the sampling template for sample area verification purposes;

xi) clean the template using no fewer than two clean wipes making sure to clean the front, back, and inner surfaces. Discard all used gloves and dirty wipes.

The following steps are required for wipe sampling of windowsills:

- i) pull on a pair of clean, powderless, disposable vinyl gloves;
- ii) mark an outline of the sampling location using masking tape. Care should be taken to minimize any disruption of dust at the sampling location. For areas that are dirty or contain high dust levels, new tape may have to be applied more than once to get adhesion to the surface. Discard any soiled tape in a refuse bag;
- iii) discard any gloves used to mark the area in a refuse bag and pull on a new pair of clean, powderless, disposable vinyl gloves;
- iv) remove an appropriate wipe from its packaging making sure it does not touch any surfaces;
- v) first wiping, one direction, side-to-side: Hold one edge of the wipe between the thumb and forefinger, draping the wipe over the fingers of a gloved hand. Hold fingers together, hand flat, and wipe the selected surface area, starting at either corner furthest away from the operator, using a slow side-to-side (right to left or left to right) sweeping motion. During wiping, apply pressure to the finger tips. At the end of the first pass, carefully lift the leading dust into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half with the sample side folded inside the fold;
- vi) second wiping, one direction, side-to-side: Using a clean side of the wipe, repeat the previous step using a wiping motion in the reverse direction;
- vii) third wiping, clean corners: using a clean side of the wipe, perform a third wiping around the perimeter of the sampling area to collect any dust remaining in the corners. Start from the middle of one edge of the area and use the same wiping technique as described above. When the perimeter has been wiped and the starting location reached, carefully lift the leading dust line into the wipe using a slight rolling motion of the hand to capture the dust inside the wipe. Fold the wipe in half one more time with the sample from this third wiping folded inside the fold;
- viii) insert the folded wipe into a sample jar. Label the jar with a DCS sample label detailing sample location and property sampled;
- ix) make a sketch of the sample location in a field notebook. Make an accurate measurement of the inner dimensions of the sampled area to the nearest one millimetre and record this in field notes. Remove all tape carefully and discard in the refuse bag;
- xi) discard all gloves in a the refuse bag.

### 3.2. Microvac Sampling

Microvac sampling is required for sampling of asbestos and MMVF in residential and non-residential units. .

The following equipment is required for microvac sampling: 1) painters' tape (used for holding down sampling templates and marking sample locations), 2) sample bags, 3) sample labels, 4) sampling template (90 cm<sup>2</sup> reusable plastic templates both in square and "L" shapes), 5) measuring tape, 6) sampling cassettes, 7) field notebook, 8) indelible ink marker, 9) ink pens, 10) refuse bags, and 11) disposable powderless, vinyl gloves

The following steps are required for microvac sampling:

- i) pull on a pair of clean, powderless, disposable vinyl gloves;
- ii) mark the area to be sampled using one of the following two procedures:

Template Assisted Marking: carefully place a sampling template on the surface in a manner that minimizes disturbance of settled dust. When sampling curtains use a stiff piece of cardboard or a table to drape curtains over to assist in taking sample. When sampling upholstered furniture use Manual Marking. Tape the outside edge of the template to prevent it from moving during sample collection.

Manual Marking of Sample Area: mark an outline of the sampling location using painters' tape. Care should be taken to minimize any disruption of dust within the sampling location. For areas that are dirty or contain high dust levels, new tape may have to be applied more than once to get adhesion to the surface. Discard any soiled tape in a refuse bag;

- iii) discard any gloves used to mark the area in a trash bag and pull on a new pair of clean, powderless disposal vinyl gloves;
- iv) if not pre-labelled from pre-field processing, label a filter cassette with an ink marker. Remove the inlet and outlet plugs and place them into a labelled resealable plastic bag. Attach the outlet to the air sampling pump with a piece of flexible tubing 40 cm in length. Attach the collection nozzle to the inlet side of the filter cassette using a short section of new tubing (less than 1.25 cm). Always use a new section of tubing for the inlet side of the filter cassette;
- v) first vacuuming: one direction, side-to-side: With the air-sampling pump on, vacuum the selected sampling surface area, starting at either of the corners furthest from the operator, using a slow side to side sweeping motion while holding the collection nozzle at an angle of approximately 45° to the sampling surface. Avoid pressing down hard on

the sampling surface during sample collection. Move the nozzle at a rate of approximately 5-10 cm per second. At the end of the first pass from one side to the other, carefully lift the collection nozzle and repeat the one side to the vacuuming sweep in the same direction as the first, using a slightly closer overlapping pass. Care must be taken to avoid overloading of the filter cassette. Repeat the procedure until the entire sampling area has been covered using the one-direction, side-to-side sweeping motions;

vi) overloading will result in decreased air flow and a reduction in sample efficiency and increased sampling bias toward smaller, less dense particles. A drop of airflow of more than 10% is an indicator of overloading. If overloading of samples becomes evident, reduce the sampling area to prevent filter overloading or use multiple cassettes for collection within the same sample area;

vii) second vacuuming: one direction, top-to-bottom: with the air-sampling pump on, vacuum the selected sampling surface area, starting at a far corner, using a slow top-to-bottom sweeping motion in the same manner as described above. Repeat the procedure until the entire sampling area has been covered using the one-direction, top-to-bottom sweeping motions;

viii) third vacuuming: one direction, side-to-side: With the air-sampling pump on, vacuuming the selected sampling surface area, starting at a far corner, using the slow, one-direction, side-to-side sweeping motion described above. Repeat the procedure until the entire sampling area has been covered using the one-direction, side-to-side sweeping motions;

ix) remove the filter cassette from the inlet and outlet tubing sections, replace the cassette plugs, and place the sample into a labeled, resealable plastic bag. Using a tape measure, measure the dimensions of the sampled area to within 1 mm, record this measurement in a field book. Label the sample bag with an identifier unique to the sample and sketch the sample location in a field book along with the unique sample identifier;

x) discard used gloves and tape in a refuse bag;

xi) reassess calibration of the sampler and record current calibration level. Determine percent difference between the original and current vacuum calibration.

The microvac will need to be cleaned between each sample. The following steps are required for microvac cleaning:

i) the 15 mm long tygon connector tubing between cassette and collection nozzle should be changed and discarded;

ii) following removal of the 15 mm long tygon tubing connector from the stainless steel nozzle, flush any collected dust from the nozzle with compressed gas such as 1,1-difluoroethane compressed gas cleaner or equivalent;

iii) following completion of sampling in each residence, clean stainless steel nozzles, as follows:

- wash nozzles using laboratory grade phosphate free detergent such as Sparkleen at a ratio of 5 ml detergent:1 R water;
- thoroughly rinse using municipally treated tap water;
- complete a final rinse with deionized water;
- air dry to remove all moisture from the interior surface of the nozzle.

iv) remove and discard the connector tubing between the cassette and personal pump when the tubing becomes damaged or restricts flow.

### **3.3 HEPA Vacuum Sampling**

Detailed sampling procedures are attached.

### **3.4 HVAC Sampling and Evaluation**

Detailed sampling and evaluation procedures are attached.

### **3.5 Air Sampling**

Detailed sampling procedures are attached.

### **3.6 Asbestos Survey**

If an exceedance of a benchmark is documented in a unit a survey to determine the source of the problem will be conducted. The procedures to be followed are those described in:

40CFR 763.85 Inspections and Reinspections

40CFR 763.86 Sampling

40CFR 763.87 Analysis

40CFR 763.88 Assessment

### **3.7 Lead Survey**

If an exceedance of a benchmark is documented in a unit, a survey to determine the source of the problem will be conducted. If an exceedance of a benchmark is documented for the building as a whole, a survey to determine the source of the problem will be conducted. The procedures to be followed are those described in: U.S. Department of Housing and Urban Development; Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing; Chapter 7: Lead-Based Paint Inspection.

**Collection of Indoor Dust Samples from Carpeted Surfaces for Chemical Analysis  
Using a Nilfisk GS-80 Vacuum Cleaner**

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## **1.0 SCOPE AND APPLICATION**

The purpose of this Standard Operating Procedure (SOP) is to define the procedures for collection of embedded dust samples that can then be analyzed for lead, pesticides, or other chemical compounds and elements. This procedure is applicable for the collection of samples on a variety of surfaces.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

## **2.0 METHOD SUMMARY**

Sample collection is performed utilizing the Nilfisk GS-80 vacuum cleaner equipped with a high efficiency particulate air (HEPA) filter. A diagram of the Nilfisk GS-80 vacuum cleaner is presented in Figure 1. Soil and other particulate matter with aerodynamic diameters of approximately 5-micrometers (  $\mu$ m) and larger, that are embedded within carpets or other surfaces, are collected and returned to the laboratory for sieving and analysis.

## **3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE**

Following collection of the sample into a dedicated collection bag, the bag is removed from the vacuum cleaner and placed into a 32-ounce glass jar or a zip-lock plastic bag. Storage of the samples at ambient temperature is appropriate for samples that will be analyzed only for metals.

Note: Samples for organic analysis should be maintained at approximately 40C.

## **4.0 INTERFERENCES AND POTENTIAL PROBLEMS**

There are no known interferences with this method.

## **5.0 EQUIPMENT/APPARATUS**

### **5.1 Equipment List**

- \_Nilfisk Model GS-80 vacuum cleaner
- \_Two meter folding ruler or similar device
- \_Masking tape
- \_Clean aluminum foil

- \_Shaker sieve, as specified in ASTM D4222, with 100-mesh screen
- \_Analytical balance [sensitive to a minimum 0.1 milligram (mg) and weighing range of 0.1mg - 1000 grams(g)].
- \_Distilled water
- \_Methanol
- \_Kimwipes TM or other laboratory tissue
- \_Vacuum collection bags
- \_Bottle brush
- \_Scrub brush
- \_Polyliners
- \_32-ounce glass jars

## **6.0 REAGENTS**

Methanol and distilled water are required for sampling train cleaning and decontamination.

## **7.0 PROCEDURES**

### **7.1 Preparation**

The overall sampling strategy should be designed to address the goals of the study. Users should consider factors such as foot traffic volume, types of activities, and proximity to potential sources. The sampling strategy should be described in the Quality Assurance Work Plan (QAWP) prepared prior to the sampling event. The ideal sampling locations are those areas that conform with the overall sampling strategy. For example, protocol may require the selection of a carpeted area for sampling where small children play or are likely to play.

1. Determine the extent of the sampling effort, the sampling methods to be employed, the amount of dust needed to reach the desired detection limit and the types and amounts of equipment and supplies needed.
2. Obtain and organize the necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, as specified in Section 7.5, and ensure that it is in working order.
4. Prepare schedule and coordinate with staff, client, regulatory agency, as appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific Health and Safety Plan.

6. Measure the area to be sampled and outline it using masking tape or other appropriate methods. Draw a diagram of the room(s) where the sample(s) were taken, locating the sampled area(s).

## 7.2 Calibration Procedures

The Nilfisk GS-80 vacuum cleaner has no flow devices that need calibration prior to sampling. The sampling train shall be thoroughly inspected to ensure that it has been cleaned, properly assembled, and complete.

## 7.3 Field Operations

1. Prior to sample collection at the location to be sampled, complete a sample data sheet, recording all requested information and sketch the area to be sampled. A sample data sheet is provided in Figure 2.

2. Select a sampling area according to the established protocol defined in the QAWP. In most cases, three rooms per floor are selected for sampling in each building. Each sample is collected with a dedicated sampling train that has been properly assembled, cleaned, and decontaminated to ensure sample integrity. The size/weight of each sample is dependent on the goals and objectives of the sampling event, the analyses requested, and the desired method detection levels (MDLs). A 100-gram sample is highly desirable if multiple analyses (metals, pesticides, etc.) are requested. A minimum 5-10-gram sample is required for metal analysis.

3. Utilizing the 2-meter folding ruler or any other measuring device, outline and mark the recommended 1-m<sup>2</sup> portion of the area to be sampled.

4. Begin the sample collection at one corner of the delineated sample area, moving the sampler back and forth four times over a strip running in a straight line between the defined sampling area edges. The width of the strip is defined by the width of the sampling nozzle. After completing the first strip, angle over to the second strip gradually on the next pass, again completing four double passes.

5. Continue sampling the area delineated until an adequate sample is collected. To determine if adequate sample weight will be collected, one must use visual judgement or perform the finger judgement test on the surface to judge the dust loading of the area and make a decision on whether to sample the recommended 1-m<sup>2</sup> area or a larger area. If sampling a larger area, measure the area accurately and document.

6. Wearing surgical gloves, make sure to tap with your hand on the nozzle inlet to dislodge any dust remaining in the nozzle or the hose. This procedure will ensure

complete sample recovery. Turn off the vacuum cleaner and allow to sit undisturbed for at least 30 seconds. Unsnap the two vacuum container clips to access the inside of the container. Remove the polyliner and the vacuum collection bag within it. Then seal off the polyliner with the vacuum collection bag inside, and transfer to a properly labeled 32-oz. glass jar or plastic bag. Document the sample and store for shipping to the laboratory.

#### **7.4 Laboratory Operations**

Upon arrival at the laboratory, recovery of the dust samples from the GS-80 dedicated collection bags is accomplished by the following procedure:

1. Select a clean working area in the laboratory where recovery of the samples is to be performed (a 4-foot by 4-foot area will be sufficient). Make sure that the following equipment/apparatus is available, assembled, and in good working condition:

\_Shaker sieve (No. 100), as specified in ASTM D-422 with particle size separation of 150  $\mu$ m. A complete set consists of three components: the cover, the screen, and the receiver pan. The receiver pan must be pre-weighed and its weight recorded.

\_Sieve shaker for mechanical sieving. Models readily available are CSC Scientific Company, Inc. Catalog No. 18480 and Thomas Scientific Catalog No. 8324\_A10 (Tel 800 345-2100).

\_Analytical balance sensitive to a minimum 0.1 milligrams (mg) and weighing range of 0.1 mg to 1000 grams (g).

\_Surgical gloves. Thomas Scientific Catalog No. 5761-W14.

\_Disposable dust mask. Thomas Scientific Catalog No. 8055- M20.

\_Camel's Hair Brush. Fisher Scientific Catalog No. 03-655.

\_Clean aluminum foil.

\_Kimwipes™ or other laboratory tissue.

2. Wearing clean surgical gloves to handle the bags and a dust mask for dust protection, retrieve the vacuum collection bags from the 32-ounce glass jars used to transport the bags from the field to the laboratory.

3. Empty the contents of the bag into the No. 100\_mesh sieve screen through the bag opening. Complete this operation by removing the plastic adaptor from the collection bag inlet. Shake the bag as necessary to ensure all the contents have been transferred through the screen to the receiver pan.

4. Place the cover on the sieve screen and manually or mechanically shake the sieve for a minimum of 5 minutes and a maximum of 10 minutes until all the fine dust particles are collected in the bottom receiver pan. If manual shaking is performed, the directions in D-422 of ASTM must be followed: "Conduct the sieving operation by means of a lateral and vertical motion of the sieve, accompanied by a jarring action in order to keep the sample moving continuously over the surface of the sieve. Continue sieving until not more than 1 mass percent of the residue on a sieve passes that sieve during 1 minute of sieving".

If mechanical shaking is performed, set up the recommended sieve shaker on an even and stable surface. Proceed with the sieving operation following directions in the manufacturer's manual.

5. Re-weigh the receiving pan utilizing the analytical balance. The difference in weight is the weight of the sieved sample. If total weight of material is desired, the coarse material remaining on top of the sieve must be collected on a pre-weighed sheet of aluminum foil, re-weighed and the weight added to the weight of the sieved sample.

6. Transfer the sieved sample from the receiving pan to an 8-ounce wide mouth glass jar. Use the camel's hair brush to ensure complete transfer of the sample. Cap glass jar and secure sample.

7. Document each sample. Each sample must be provided with the following information: identification number, date of sampling, location, analysis requested. Each sample must be recorded into a chain-of-custody form before delivery to the analytical laboratory.

8. Before processing the next sample, thoroughly wipe clean the shaker sieve set with a Kimwipe™. Wait until dry. Repeat steps 1 through 7.

## **7.5 Sampling Train Decontamination**

To decontaminate the sampling trains, move them to a well ventilated area and perform the following:

1. Assemble one of the sampling trains to be used as the decontamination unit for decontaminating the nozzles, hoses, and wands. This unit must be provided with a clean polyliner and dust bag.

2. With the vacuum cleaner turned on and wearing clean surgical gloves, the nozzles, wands, and hoses are decontaminated using the bottle brush to remove any accumulated dust in the hose and nozzle. Make sure to tap with your hand on the nozzle to remove any visible dirt that have accumulated and use the scrub brush to remove any hair or fibers entangled on the nozzle's brush . When the nozzle is considered to be clean, remove and spray with reagent grade methanol and allow to air dry on a clean surface. The wand and hose are then cleaned with the bottle brush. Make sure to tap with your hand on the wand inlet while cleaning with the bottle brush to remove any visible dirt. Repeat this procedure to decontaminate the other nozzles, wands, and hoses.
3. Pull out the dirty dust bag from the decontamination unit and wipe clean the inside of the container with distilled water. Do the same to the other containers. Spray the inside of the containers with methanol and allow to air dry. If decontaminating in between homes, wipe cleaning the inside of the containers with distilled water is sufficient.

## 8.0 CALCULATIONS

The dust weight calculations for the final sieved dust fraction is performed in accordance with ASTM Method D 422. Dividing the final dust weight by the area sampled (expressed in m<sup>2</sup>) provides dust loading in grams per squared meter ( g/m<sup>2</sup> ). When the analysis results are received, the loading of analyte per square meter of surface area (ug/m<sup>2</sup>) can be calculated in the same way. Analysis will also provide mg/kg concentration. If total (gross) dust loading of the sampled area needs to be calculated, the total dust weight before sieving must be obtained. The total dust weight is divided by the area sampled to obtain total dust loading per square meter.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instruments must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to **sampling/operation and they must be documented.**

## 10.0 DATA VALIDATION

Results of the quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results accordingly with the project's data quality objectives.

## **11.0 HEALTH AND SAFETY**

When working with potential hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures.

## **12.0 REFERENCES**

American Society For Testing And Materials, Standard Practice for Collection of Dust from Carpeted Floor for Chemical Analysis, Designation D 5438-93, Reprinted from the Annual Book of ASTM Standards, Philadelphia, PA.

American Society For Testing And Materials, Standard Test Method for Particle Size Analysis of Soils, Designation D 422-63, Reprinted from the Annual Book of ASTM Standards, Philadelphia, PA.

American Society For Testing And Materials, Standard Practice for Field Collection of Organic Compounds from Surfaces Using Wipe Sampling Designation D 6661-01

Instructions for Use-Nilfisk Model GS 80, Nilfisk of America, Inc., Malvern, PA (1987).

## **HVAC Sampling and Evaluation Procedures**

### **1.0 SCOPE**

The procedures contained in this document provide guidance for sampling to determine the presence of WTC-related contaminants in ventilation systems. This document is solely concerned with determination of the presence of asbestos, lead, PAHs and MMVF in ventilation systems. Determining the exact nature of all hazardous air contaminants and contaminants other than contaminants that may have been released during the WTC collapse and that may have potentially impacted ventilation systems operating at the time of the collapse is beyond the scope of this document.

This document provides general guidance to address the following with respect to ventilation systems impacted by WTC-related dust:

- Professional, health and Safety Requirements for Individuals performing the evaluations
- Evaluation Procedures (Visual Assessment, Historical Assessment, and Sampling Procedures)
- Post-Cleaning Visual Inspection Procedures

This document is limited in scope to evaluation of environmental conditions within the ventilation systems to determine the concentrations and locations of asbestos, lead, PAHs and MMVF that are present. This document is not concerned with the following:

- Mechanical operation of the systems
- Environmental conditions, contaminants, or other conditions within the systems that are not related to the WTC collapse
- Recommendations and procedures that by their nature must be contaminant-specific

### **2.0 PURPOSE**

The purpose of this document is to provide procedures for inspecting and sampling ventilation systems to determine the concentrations and locations of asbestos, lead, PAHs and MMVF that are present, and to provide guidelines for the qualifications of personnel accomplishing such inspection and sampling.

WTC-related dust is generally considered to have common, consistent, and readily observable characteristics visually and tactilely differentiating it from common dust. WTC-related dust generally contains extremely fine particles similar in consistency to talcum powder, is light-colored, contains pulverized concrete and/or gypsum wallboard, and may contain asbestos and man made vitreous fibers (MMVF).

Ventilation systems are reservoirs for environmental dust and dirt. Therefore, it may not be possible to visually differentiate between WTC-related dust and environmental dust that was



present in the ventilation system prior to or after the WTC collapse. Thus dust sampling will be performed in conjunction with visual evaluation of the systems.

### **3.0 APPLICABLE DOCUMENTS**

This section provides full bibliography for references made within this document. Evaluations should be conducted in a manner that is fully compliant with the guidance provided in the following documents, to the extent applicable.

ACR 2002, Assessment, Cleaning and Restoration of HVAC Systems, National Air Duct Cleaning Association, Washington, D.C. (2002).

Section 3 of ACR 2002 includes procedures for performing a visual assessment of HVAC systems required in item 6.5.2.1 of this document.

NADCA Standard 97-05, Requirements for the Installation of Service Openings in HVAC Systems, National Air Duct Cleaning Association, Washington, D.C. (1997).

NADCA 97-05 includes procedures for installing service openings in HVAC systems and construction and material specifications for replacement panels, plates or access doors to cover such openings as required under item 6.5.1.2 of this document.

SMACNA HVAC Duct Construction Standards - Metal and Flexible, Sheet Metal and Air Conditioning Contractors' National Association, Inc., 2nd Edition (1995).

The SMACNA standard includes construction and material specifications for access doors for covering service openings as required under item 6.5.1.2 of this document.

SMACNA Fibrous Glass Duct Construction Standards, Sheet Metal and Air Conditioning Contractors' National Association, Inc., 6th Edition (1992).

The SMACNA standard includes construction and material specifications for access doors for covering service openings as required under item 6.5.1.2 of this document.

NFPA Standards 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, and 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems, National Fire Protection Association (1999 Edition).

The NFPA standards include construction and material specifications for replacement coverings on service openings as required under item 6.5.1.2 of this document.

OSHA Regulations 29 CFR 1910, Occupational Health and Safety Standards

The OSHA regulations specify health and safety requirements for protecting employees during the inspection procedures.

All samples to be collected are to use the "HEPA Vacuuming Method Used by EPA's Emergency Response Team- Collection of Indoor Dust Samples from Carpeted Surfaces for Chemical Analysis"

#### **4.0 PROFESSIONAL, HEALTH AND SAFETY REQUIREMENTS FOR INDIVIDUALS PERFORMING THE SAMPLING AND EVALUATION**

Many older ventilation system components contain both friable and nonfriable asbestos and may contain various contaminants such as mercury, PCBs, lead and microbial contamination. Aside from these contaminants, asbestos-containing pipe insulation, plaster and other asbestos-containing building materials may be disturbed during evaluation of ventilation equipment. Safety hazards such as fall hazards, electrical hazards, and mechanical hazards also may be encountered during evaluation of ventilation equipment. Due to the potential presence of these health and safety hazards, this section specifies minimum professional requirements for individuals performing the evaluations, as well as health and safety requirements pertinent to conducting the sampling and evaluation. It is not the intention of this document to provide all applicable health and safety requirements. It is expected that the entities performing work are knowledgeable in all federal, state and local health and safety requirements and standards pertinent to conducting the evaluations. This document references several key OSHA standards relevant to this work.

##### **5.1 Sampling and Evaluation Team**

All evaluations shall be performed in teams consisting of a qualified HVAC/Electrical Professional and a qualified Environmental Professional. For large central air systems, it may be helpful to supplement the team with a Sheet Metal Professional; this will require the prior approval of the project manager.

##### **5.2 HVAC/Electrical Professional - Requirements**

1. The HVAC/Electrical Professional shall be an employee of a professional, licensed mechanical ventilation contracting or engineering firm.
2. The HVAC/Electrical Professional shall be able to demonstrate competency and document experience in the following areas: air handling equipment identification and access, identification of system components, and installation of service openings in sheet metal and fibrous glass ducts in accordance with NFPA, NADCA and SMACNA guidelines and NYC building codes.
3. The HVAC/Electrical Professional shall have received training from their employer for reasonably anticipated hazards during HVAC work including training required under OSHA

standards, including but not limited to lockout/tagout, fall protection, and personal protective equipment standards.

NOTE: If necessary, a licensed electrician shall be subcontracted to de-energize electrically operated equipment in accordance with OSHA's lockout/tagout requirements.

4. The minimum personal protective equipment required for use by the HVAC/Electrical Professional includes:

- a. a supply of disposable protective coveralls
- b. a supply of disposable protective gloves
- c. safety glasses
- d. respiratory protection as specified in item 5 below

5. The HVAC/Electrical Professional shall be capable of wearing and shall be provided with a P100 air purifying respirator with appropriate medical determination, fit testing and training as required under OSHA's personal protective equipment standard.

6. The HVAC/Electrical Professional shall have received 2-hour asbestos awareness training.

7. The HVAC/Electrical Professional shall be responsible for:

- a. the lockout/tagout of electrical or mechanical hazards required to safely perform the evaluations;
- b. the HVAC/Electrical Professional's firm shall provide sound equipment as needed to meet OSHA's fall protection requirements that may be applicable to parts of the evaluations and the HVAC/Electrical Professional shall be responsible for implementing the use of such equipment;
- c. locating and identifying ventilation system components to be included in the evaluation;
- d. any disassembly of any ventilation equipment and components required to complete the evaluation, and proper re-assembly following the evaluation; and
- e. assist the Environmental Professional in making determinations required in Item 6.4.

### **5.3 Sheet Metal Professional - Requirements**

Requirements for the Sheet Metal Professional, if part of the evaluation team, are identical to those listed in item 5.2 for the HVAC/Electrical Professional.

### **5.4 Environmental Professional - Requirements**

The Environmental Professional shall hold a current EPA accreditation as an AHERA Building Inspector. The primary purpose of the asbestos certification requirement is to be able to identify asbestos-containing materials and asbestos-related hazards in order to avoid the disturbance of asbestos-containing materials during the evaluations.

1. The Environmental Professional shall have current EPA accreditation as an AHERA Building Inspector in any U.S. state.
2. The minimum personal protective equipment required for use by the Environmental Professional includes:
  - a. a supply of disposable protective coveralls
  - b. a supply of disposable protective gloves
  - c. safety glasses
  - d. respiratory protection as specified in item 3 below
3. The Environmental Professional shall be capable of wearing and shall be provided with a P100 air purifying respirator with appropriate medical determination, fit testing and training as required under OSHA's personal protective equipment standard.
4. The Environmental Professional is responsible for:
  - a. ensuring that no asbestos-containing materials are disturbed during the evaluations
  - b. determining which personal protective equipment will be used by the HVAC/Electrical Professional, the Sheet Metal Professional and by the Environmental Professional during the evaluation; and
  - c. collecting HEPA vacuum samples that are necessary to complete the evaluation;
  - d. making determinations required in Item 6.3; and
  - e. cleaning up any debris that may be disturbed as a result of the evaluation using a HEPA vacuum.

## **6.0 EVALUATION PROCEDURES**

### **6.1 General**

Ventilation systems are likely to vary widely in type, configuration and complexity. This evaluation procedure applies considers three general categories of ventilation systems that may be encountered in buildings:

1. Ventilators, wall air conditioning units and window air conditioning units in common spaces;
2. Fan coil or heat pump units in common spaces; and

### 3. Central systems with heating and/or cooling capabilities.

Wall air conditioning units and window air conditioning units which serve an individual residence and exhaust systems such as bathroom and kitchen exhaust fans that directly remove room air to the outdoors are not described in this evaluation procedure. When directed by the project manager sampling and evaluation of these systems may be performed using the same principles outlined for items 1, 2, and 3 above. The vertical risers that typically run the height of the building through a series of apartments present the potential for dumping dust into apartments below when you attempt to examine the interior of the system. Similarly, any ventilation equipment encountered that does not fall into any of these categories can be inspected using principles outlined in this section.

The locations within the ventilation system equipment expected to have the greatest impact from WTC-related dust include air intakes and intake ducts, intake air dampers, intake air filters and various system components located downstream of the intake air filters, depending on the system's filtration efficiency. Dust may collect at potential impingement points such as duct terminations, transitions and elbows, and interior system components such as control devices, dampers, thermal coils, turning vanes, fans, etc.

One factor that may be considered in performing the evaluation is whether or not the ventilation equipment operated during the WTC collapse and in the weeks immediately following the collapse. Equipment that was not operating due to power loss, or due to concerns about entrained dust may not have been impacted as heavily as equipment that operated throughout the collapse and immediate clean-up response.

Item 6.3 includes a listed of recommended equipment for performing the sampling and evaluation.

Item 6.4 includes a list of system components for each equipment category.

Item 6.5 includes the sampling and evaluation procedures that may be applied to each system component.

## **6.2 Documentation of Existing Mechanical Conditions**

Prior to the start of the evaluation, the HVAC/Electrical Professional shall ensure that the ventilation system is cycled and that there are no obvious existing deficiencies affecting proper mechanical operation of the system for which the evaluation team may later be held responsible.

## **6.3 Recommended Supplies and Equipment**

Personal protective equipment (see 5.0)

Sampling supplies (see 6.5.2.3)

Disposal bags (see 6.5.2.3)  
Spray bottle containing soapy water  
Cleaning cloths  
Ladders (as needed)  
Lifts or scaffolding (as needed)  
Extension cords  
Hand tools (screw driver, pliers, etc.)  
Cordless drill with a ½ inch metal cutting bit.  
Rotary metal cutting saw  
For covering service openings, sheet metal plates, panels or access doors meeting  
NADCA 9705, NFPA 90A/90B and SMACNA specifications  
Telescoping inspection mirrors and flashlights  
Boroscope  
Nilfisk vacuums or equivalent (sample collection)  
HEPA vacuum (clean up)

#### **6.4 Typical system components for each equipment category**

The ventilation systems may contain, but may not necessarily be limited to combinations of the listed components in each category.

##### **6.4.1 Ventilators, wall air conditioning units and window air conditioning units in common spaces**

Outside air intake louvers, grates and screens  
Outside air duct  
Outside air dampers  
Return air grille  
Return air plenum  
Filter rack  
Filter media  
Coils (evaporator)  
Blower assembly  
Condensate drain pan  
In-line electrical resistance strip heaters (in supply ducts connected to unit ventilators)  
Fire dampers  
Turning vanes  
Supply plenum or supply duct liner  
Supply air diffuser

##### **6.4.2 Fan coil/heat pump units in common spaces**

Return grille  
Return air plenum

Filter rack  
Filter media  
Blower assembly  
Thermal coils  
Supply plenum  
Supply diffusers

### **6.4.3 Central air system**

Outside air intake louvers, grates and screens  
Outside air duct  
Outside air dampers  
Return air grilles  
Return air plenum  
Return air plenum damper  
Return air ducts  
Turning vanes  
Mixing chambers  
Filter rack  
Filter banks/media  
Pre-heat coils  
Cooling coils  
Re-heat coils  
Humidification and/or air cleaning equipment  
Fire dampers  
In-line reheat coils  
Interior insulation  
Duct connectors  
Blower assembly including blower wheel, blower housing, air vanes, in-line noise attenuators, acoustical treatments (e.g., baffles, duct linings)  
Condensate drain pan  
Condensate accumulator  
Supply air plenum  
Supply air plenum damper  
Supply plenum or supply duct linings  
Supply air ducts (high and low pressure)  
Supply air diffusers  
Terminal boxes  
Open or ducted passive ventilation shafts

## **6.5 Sampling and Evaluation Procedures**

### **6.5.1 Accessibility**

### **6.5.1.1 Locate System Components Accessible for Visual Inspection**

The HVAC/Electrical Professional shall make an assessment of the accessibility of the various components of the system. For example, components may be enclosed within permanent sheet metal panels, or may be located above or behind solid plaster ceilings and walls.

Determine the components that are accessible. At minimum, representative surfaces of the following system components should be inspected:

- air intake (outdoor or return)
- air intake dampers
- return air grilles
- return air plenum
- horizontal surfaces
- impingement points (e.g. turning vanes, elbows, transitions)
- filter racks and filter media
- blower
- thermal coils
- interior surfaces of the supply air ducts
- horizontal surfaces
- impingement points (e.g. turning vanes, elbows, transitions)
- volume dampers
- terminal boxes
- supply diffusers

Note that depending on the size and complexity of the HVAC system, access may require the use of ladders, lifts or scaffolds using appropriate methods of fall protection.

### **6.5.1.2 Methods of Access**

The following list summarizes methods of accessing HVAC system components for inspection:

- through existing service openings (i.e., access doors and panels)
- by disassembly of housing
- by installation of service openings (may range from 1" diameter holes to access doors)

The HVAC/Electrical Professional shall assess the accessibility of each HVAC system component to be inspected. If an HVAC system component is not accessible, the Environmental Professional shall be consulted to determine whether installation of a service opening will likely disturb asbestos-containing materials. After such consultation, if approved by the Environmental Professional, the HVAC/Electrical Professional shall install service openings as needed to inspect the HVAC components listed in 6.5.1.1.



NOTE: Disassembly of housing and installation of service openings may only be performed by the HVAC/Electrical Professional and replacement plates, panels or access doors shall be installed in accordance with NFPA, NADCA and SMACNA standards and NYC building codes.

The Environmental Professional shall repair or seal any interior/exterior duct insulation disturbed by the installation of service openings.

## **6.5.2 Methods of Evaluation**

### **6.5.2.1 Visual Inspection Procedure**

The HVAC/Electrical Professional and the Environmental Professional should jointly perform the visual inspection. At minimum, the components listed in 6.5.1.1 shall be inspected.

The visual inspection shall be accomplished using one or more of the following methods:

- direct examination
- telescoping inspection mirrors and flashlights inserted through service openings
- boroscopes inserted through supply air diffusers or other existing openings
- remotely operated video camera

### **6.5.2.2 Assessment of Conditions**

#### **Visual Assessment**

All required interior surfaces in contact with the air stream shall be inspected for visible accumulations of dust and/or debris. Inspect all surfaces in contact with the air stream. Information indicates that some of the defining characteristics of WTC-related dust are that it contains extremely fine particles similar to talcum powder in consistency, is light-colored, contains pulverized concrete and/or gypsum wallboard, and may contain asbestos fibers. The visual inspection shall document:

A general description of the appearance of interior surfaces of the various system components. The description for each component will include, but may not be limited to:

- " interior duct/fan housing surfaces are porous/non-porous
- " interior duct and fan housing surfaces are lined with insulation
- " interior duct and fan housing surfaces are double-walled (i.e. interior insulation with perforated metal cover)
- " filter loading, condition of filters and filter rack
- " interior surfaces are free/not free of visible dust and debris or suspect WTC-related dust and debris
- " description of dust color, level of dust loading that may include:

the depth of dust observed on each component (e.g., less than 1/16 inch, greater than or equal to 1/16 inch.).

the depth and location of dust on ducts and fan housing (i.e., on interior bottom, top and sides of ducts)

visually estimated percentage of surface area with dust, whether or not there are materials that are likely not associated with WTC-related dust such as building-related asbestos-containing materials, animal carcasses, delaminating lining material, visible mold growth, water damage, fecal matter, feathers or other evidence of animals, etc.

## **Historical Assessment**

The evaluation team shall attempt to describe any other available information from site occupants or building managers, such as the known status of system operating conditions at the time of the WTC collapse, ventilation system maintenance (i.e., cleanings, filter changes, or replacement since the WTC collapse).

Based on these assessments, to the best of his/her ability the Environmental Professional will state a general impression of the overall cleanliness of each component, and whether or not it appears to be impacted by WTC-related dust.

### **6.5.2.3 Environmental Sampling Procedure**

In the absence of environmental sampling that indicates otherwise, WTC-related dust shall be assumed to be an asbestos-containing material and cleaning procedures shall be performed in accordance with procedures for asbestos decontamination (see section 5.0).

#### **Sampling Procedures**

1. Sampling of interior dust may only be performed by the Environmental Professional.
2. Minimum personal protective equipment used by the Environmental Professional shall include a disposable protective coveralls, a P100 respirator, safety glasses, and disposable gloves.
3. A HEPA vacuum shall be on-site for clean-up, if needed.
4. Dust samples will be collected from any visible deposits in each of four areas within the HVAC 1) the air intake or air intake damper, 2) the intake air filter(s), 3) mixing plenum or any other areas down stream of intake air filters, 4) all the outlets in units where accessible, infrequently accessed and inaccessible samples are to be collected. Frequently, dust will be more likely to accumulate on horizontal surfaces, although this may not always be the case.
5. Sample collection

Nilfisk HEPA samples 50gram (approximately 50cc) composite samples will be collected for areas 1 (intake), 3 (plenums) and 4 (outlets); for each of the samples collected the date, building name, and specific locations the sample was collected from, and the area(s) and depth of dust vacuumed will be measured and reported. The sample from the air intake will be a composite of all intakes sampled. Separate plenum (and other area where dust is observed) and outlet samples will be collected on each floor serviced by the HVAC.

Bulk sample(s) For the air intake filter(s) use a disposable brush to collect dust/particulate matter in a stainless steel bowl. Transfer sampled dust/particulate matter into sample container. Required sample mass is at least 50 grams (approximately 50cc). Approximately equal volumes should be collected from each filter present. For each sample collected the date, building name, and specific locations the sample was collected from, and the area(s) and depth of dust collected will be measured and reported

#### 6. Completion of sampling

The Environmental Professional shall repair or seal any interior/exterior duct insulation disturbed as a result of sample collection.

At the completion of sampling, the Environmental Professional shall wipe the outside of his/her respirator with a clean, wet, disposable cloth and shall place the respirator into a clean, sealed plastic bag. Clean any suspect debris or contamination resulting from the sampling activities using a HEPA vacuum or wet wiping methods. All wiping cloths, disposable protective suits and gloves, and drop cloths shall be placed into a sealed polyethylene bag for proper disposal.

### 7.0 Post-cleaning Visual Inspection

If cleaning occurs at the direction of EPA cleanliness verification shall be performed by the evaluation team consisting of a HVAC/Electrical Professional and an Environmental Professional as described in section 5.0 of this document after cleaning of one or more ventilation system components has been completed.

Following cleaning, the Environmental Professional shall ensure that all interior ventilation system components that were subject to the cleaning procedures are visibly clean. An interior surface will be considered visibly clean when it is free from non-adhered substances and debris.

To determine whether a surface is visibly clean, a thorough and comprehensive visual inspection and assessment of all cleaned components shall be performed in accordance with visual procedures established in items 6.5.2.1 and 6.5.2.2 of this document. In order to observe locations that are difficult to clean, additional access openings shall be installed as needed to conduct a comprehensive post-cleaning visual inspection.